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ABSTRACT

The application of a cost-effect analysis strategy to the delivery of vocational education services by California's Regional Occupational Centers and Programs (ROC/Ps) was investigated. Data representing both program costs (revenues and expenditures) and outcomes (student completions and placements) were collected from a statewide sample representing 16.3% of the courses (n=482) and 30.4% of the over 350,000 students (n=108,759) served during 1987-88. Two survey instruments were used to collect cost and outcome data. Cost-effect ratios were calculated for several desirable outcomes, demonstrating differential levels of cost-efficiency in achieving these outcomes. Structural equation modeling, using LISREL-6, was then used to confirm an hypothesized causal network underlying these differences. Results show that program costs are positively related to the number of students enrolled in each program but not to the rates of their achieving positive outcomes from those programs. This relationship was confirmed through an analysis of the relevant legislation impacting the ROC/Ps. The legislation demonstrates a clear relationship between program funding and student enrollments but not between program funding and student outcome attainment. These findings indicate a restricted applicability of cost-effect analysis to situations in which causal linkages between costs and effects are clearly accepted. Nine tables and five figures are included. The standardized solutions for the final model are appended.
(Author/TJH)

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# Are Costs Related to Effects in Cost-Effect Analysis?

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**Abstract**

Public schools across the nation have been facing calls for increased fiscal responsibility. Using models found traditionally in market economics, policy makers request that educators demonstrate the return from particular program investments. Ratios of costs to outcomes have been examined in many areas, often suggesting alternative strategies for improvement.

This research investigated the application of a cost-effect analysis strategy to the delivery of vocational education services by California's Regional Occupational Centers and Programs (ROC/Ps). Data representing both program costs (revenues and expenditures) and outcomes (student completions and placements) were collected from a statewide sample representing 16.3% of the courses and 30.4% of the over 350,000 students served during 1987-1988. Cost-effect ratios were calculated for several desirable outcomes, demonstrating differential levels of cost-efficiency in achieving these outcomes.

Structural equation modeling (using LISREL-6) was then employed to confirm an hypothesized causal network underlying these differences. Results show that program costs are positively related to the number of students enrolled in each program but not to the rates of their achieving positive outcomes from those programs. This relationship was confirmed through an analysis of the relevant legislation impacting the ROC/Ps. The legislation demonstrates a clear relationship between program funding and student enrollments but not between program funding and student outcome attainment.

Implications for the use of cost-effect analysis in program evaluation are significant. These findings would tend to restrict the applicability of cost-effect analyses to situations in which the causal linkages between costs and effects are clearly accepted. When that linkage is weak or nonexistent educators and policy makers alike should be cautious in attributing cost-effect ratio differences to presumed programmatic differences.

## Introduction

Cost-outcome analysis is a method used to relate the factors needed to operate a given program with the outcome (or outcomes) that the program produces (Bentkover, Covello, & Mumpower, 1986). Such analyses have been applied across a wide range of interest areas (Smith and Smith, 1983) from medicine to business to education. Implicit in these studies is an acceptance that both cost and outcome can be sufficiently quantified so as to allow their comparison. This requires a clear set of definitions of exactly how the total cost and outcome will be calculated. Brinkman and Allen (1986) aptly describe many of the ways in which costs may be considered, with Thompson (1980), Levin and Seidman (1981), and Levin (1983) advocating different methods for the actual calculations. Likewise, several authors (Smith, 1984; Hanson, 1986; Levin, 1983) discuss the reduction of varied outcomes to quantitatively comparable units.

Levin (1981, 1983) synthesizes these viewpoints into four different methods for relating costs to outcomes. The simplest kind of cost-outcome evaluation is the cost-feasibility (CF) analysis (Smith and Smith, 1983). In cost-feasibility studies the desired program outcome is identical between methods of implementation. Only costs vary, with the least costly method deemed to be the best. CF analysis is frequently used as a planning model when only finite resources are available to invest in any given method.

When costs are known but program outcomes must be qualitatively analyzed to determine their worth a method of analysis known as cost-utility (CU) may be employed. CU analyses allows for the subjective comparison of different outcomes against a framework of quantifiable costs. Typically this is seen in studies where comparisons of weightings among different outcomes are made (Manpower Administration, 1983). The very flexibility of CU analysis is also, unfortunately, its drawback, since differences between raters on the relative value of any given outcome can radically affect the results of any analysis.

Social welfare theorists advocate the use of a third methodology known as cost-benefit (CB) analysis. As stated by Dunn and Sullins (1982),

> If one accepts the assumption that public resources should be invested so social welfare is maximized, then cost-benefit analysis should be used to identify investments that will achieve that result. (p. 21)

Cost-benefit analyses seek to identify all of the aspects of change associated with the conduct of a given program, both immediate and long term in nature. These changes (in standard of living, earning potential, lifestyle) are analyzed and reduced to economic gains for the individuals and/or institutions involved. Although interesting from a theoretical perspective, many authors have acknowledged the difficulty of both identifying and reducing long term social

impacts to monetary gains (Thompson, 1980; Barnett, 1985; Levin and Seidman, 1981; Hunting, Zymelman, & Godfrey, 1986).

Levin's final method for performing cost-outcome studies is known as cost-effect (CE) analysis. Using this strategy both costs and outcomes are similar in nature among competing programmatic alternatives and can be expressed in quantitative, numerical terms. The cost-effect ratio provides an index by which differing programs may be compared. Levin (1983) describes the collection of:

> ... cost and effectiveness data [which] can be combined into CE ratios that show the amount of effectiveness that can be obtained for an estimated cost. Since these ratios can be compared among alternatives, it is possible to provide information to decision makers on which alternative seem to be most parsimonious in terms of costs, with respect to the measure of effectiveness that is under scrutiny. (p. 115)

When all programmatic alternatives produce the same outcome (such as might occur in a contractual production setting) the cost-outcome analysis reduces to a simple comparison of competing costs. Likewise, when costs are fixed between alternatives (such as in a fixed price bid) only a comparison of the levels of outcome are required. It is when both costs and outcomes are variable that they must be reduced to comparable forms. Cost-effect ratios seek to provide the comparability by producing a single number representing the relative worth of each program's productivity.

Numerous studies have been undertaken using the cost-effect methodology to compare the cost-performance of competing program alternatives in education. Quinn, Mondfrans, and Worthen (1984) studied methods of mathematics education, while Fitzgerald and Hunt (1985) and Levin and Meister (1986) compared instructional methods for teaching math and reading. It appears, from these and other studies, that cost-effect analysis is the most widely used method of analysis employed when questions arise concerning the comparison of costs amongst the immediate returns from competing educational programs.

The CE ratio, however, does not provide any information about what constitutes the components of efficiency in the best program. A low value may be due to lower costs, or to a higher rate of outcome production, or both. Furthermore, the impact of costs as compared to other factors on the ability of each program to produce an outcome remains undetermined.

This becomes especially apparent when different programs operate at nearly similar costs yet are able to produce significantly different outcomes. Program efficiency could erroneously be ascribed to their lower costs rather than to the true programmatic components that are responsible for the actual variation in outcome. Such a conclusion could result in either the adoption of one particular program(s),

or a reduction in the funding of others, in an attempt to achieve the higher cost-effectiveness desired. Unless there is a clear relationship between the costs and outcomes, however, such attempts may produce less than satisfactory results. This would be due to the failure to recognize the desired outcome's true causative components and to make those more cost-efficient. This research sought to clarify the understanding of cost-outcome analysis by applying the techniques to an educational system and then to investigate the results from cost-effect ratio comparisons with the causative antecedents associated with producing the differential outcomes.

**Method**

Data for this research was solicited from the seventy Regional Occupational Center and Program (ROC/P) sites operating in California during 1987-1988. These sites provided vocational education training and job placement assistance to over 350,000 students in 2,958 different course titles. These course titles were divided into eight subject area domains, representative of the most frequent kind and enrollment of courses offered. A total of 482 courses were randomly selected from within these domains, resulting in the selection detailed in Table One.

| Subject Domain | # and % of Courses | | # and % of Enrolles | |
|---|---|---|---|---|
| Auto Repair | 64 | 13.9% | 13,655 | 12.6% |
| Office Occupations | 65 | 13.5% | 26,690 | 24.5% |
| Data Processing | 63 | 13.1% | 21,871 | 20.1% |
| Retailing | 61 | 12.7% | 13,200 | 12.1% |
| Health Occupations | 59 | 12.2% | 6,960 | 6.4% |
| Quantity Food | 61 | 12.7% | 9,680 | 8.9% |
| Cosmetology | 47 | 9.8% | 10,374 | 9.5% |
| Construction | 59 | 12.2% | 6,329 | 5.8% |
| Total | 482 | 100.0% | 108,759 | 100.0% |
| Statewide Total | 2958 | | 358,318 | |
| Percent of Statewide | | 16.3% | | 30.4% |

**Table 1: Sample Distribution by Subject Area Domain**

Two survey instruments were employed to collect the cost and outcome data. One instrument was directed to site level characteristics, soliciting information about the ROC/P's size, location, population base served, total income and expenditures, and levels of outcome achievement across all courses. The other survey collected information on the performance aspects of the individual courses, including: course revenues, expenditures, and outcome production. To insure a uniformity of data collection, the data collection categories were organized following

the standard accounting categories employed for state reporting (the J-300-ROP accounting categories and the VE-80 completion and follow-up categories). Program outcomes were collected according to the types specified for the ROC/Ps in the California State Education Code (§ 52300 (1988)): number of students completing the course of study (Completers), number of students obtaining employment after completing the course of study (Job Placements), and the number of students securing positive outcomes such as employment, returning to school, and entering the military after completing the course of study (Mission Statement Placements).

A potential problem in the analysis of data collected from sources as widespread as these would be the potential effects of course size and relative ROC/P wealth on any cost-effect ratio. It was assumed that, all other factors being equal, courses with a larger enrollment would tend to have larger numbers of completers, job placements, and positive student outcomes. To compare courses differing in the number of students enrolled it was necessary to calculate a rate of outcome attainment for each outcome. Otherwise, courses with a higher enrollment might end up showing higher outcomes not because of any true differences other than there being more students enrolled into that course. Thus, the rate of student completions, job placements, and mission statement placements was used for comparisons in later analyses.

It would also not be appropriate to simply divide the total expenditures for a course by the numbers of students achieving a particular outcome. Such a method ignores both the natural variation in course length between these subject areas as well as any consideration of student attendance or attrition throughout the program. To adjust for these factors a standardized metric of course cost was computed based on California's Average Daily Attendance (ADA) concept. Total course expenditures were divided by the total number of all student contact hours, which in turn was divided by 525 (representing the number of hours allowed by the state for a single student's annual ADA). This manipulation corrects for differences that might otherwise exist between large and small classes, or classes which had longer or shorted durations. Course expenditures could then be represented based on a "standard student" (ADA student) norm, eliminating the need to provide further correction.

Packets containing a single site-level survey and from one to eight course-level surveys (depending on which courses were selected from that site) were mailed to the seventy ROC/Ps in late January, 1989. Four of these packets were never received by their intended sites and had to be resent. ROC/P's that had not returned their survey packets by the end of February were contacted by telephone in an effort to encourage a response. This procedure was repeated in mid-March, with the data collection closing at the end of the first week in April, 1989.

## Cost-Effects Analysis

Fifty-one of the seventy ROC/P's (73%) returned their survey packets. Six packets had to be disqualified due to a large number of unanswered items, leaving a total usable sample representing forty-five ROC/Ps (64%). Of these, 307 of the original 482 courses were available for analyses (64%). To test the adequacy of the returned sample, Kolmogorov-Smirov Z and chi-square statistics were calculated. These results (KSZ = .72, p=.66 and $\chi^2$ = 2.78, p = .97) confirmed that the returned sample was adequately representative of the requested sample.

The total cost per ADA was then calculated for each course. The means and standard deviations are presented in Table Two.

| Course Area | Mean | S.D. |
|---|---|---|
| Auto Repair | 1912.19 | 556.70 |
| Office Occupations | 1830.02 | 735.96 |
| Data Processing | 1889.89 | 1061.21 |
| Retailing | 1596.48 | 720.47 |
| Health Occupations | 1923.64 | 681.88 |
| Quantity Food | 2572.09 | 1103.28 |
| Cosmetology/Barbering | 1144.94 | 570.42 |
| Construction | 2407.69 | 992.73 |

**Table 2: Mean Cost per ADA by Course Area**

One way analysis of variance tests determined that significant differences exist in course costs between the course title areas (F = 9.11, p = .00). A Student-Newman-Keuls multiple range test (at $p < .05$) confirmed that courses in cosmetology had an average lower cost than all other courses, that courses in quantity food had a higher average cost than all other courses (except construction), and that courses in construction were, on the average, more costly than all other courses except quantity food and data processing.

Rates of student attainment in the three outcome categories were computed next, and are summarized in Tables Three through Five.

| Course Area | Mean | S.D. |
|---|---|---|
| Auto Repair | .57 | .22 |
| Office Occupations | .61 | .18 |
| Data Processing | .62 | .19 |
| Retailing | .64 | .21 |
| Health Occupations | .68 | .13 |
| Quantity Food | .55 | .22 |
| Cosmetology/Barbering | .55 | .20 |
| Construction | .52 | .23 |

**Table 3: Mean Completer Rate by Course Area**

| Course Area | Mean | S.D. |
|---|---|---|
| Auto Repair | .93 | .13 |
| Office Occupations | .91 | .11 |
| Data Processing | .91 | .10 |
| Retailing | .90 | .15 |
| Health Occupations | .92 | .10 |
| Quantity Food | .89 | .16 |
| Cosmetology/Barbering | .85 | .20 |
| Construction | .90 | .16 |

**Table 4: Mean Job Placement Rate by Course Area**

| Course Area | Mean | S.D. |
|---|---|---|
| Auto Repair | .90 | .15 |
| Office Occupations | .88 | .14 |
| Data Processing | .89 | .15 |
| Retailing | .88 | .16 |
| Health Occupations | .90 | .09 |
| Quantity Food | .84 | .22 |
| Cosmetology/Barbering | .79 | .21 |
| Construction | .89 | .16 |

**Table 5: Mean Mission Statement Rate by Course Area**

One way analyses of variance on these tables reveal no significant differences between the courses for the job placements ($F = .83$, $p = .55$) and mission statement positive outcomes ($F = 1.38$, $p = .21$). The analysis of variance for course completion rates showed significantly different between courses ($F = 2.26$, $p = .03$). A Student-Newman-Keuls multiple-comparison test (at $p < .05$) revealed

that health occupations courses had significantly higher placement rates than courses in construction for the completer rates.

Cost-effect ratios were then computed for each of the three outcome categories in each of the eight subject areas. These ratios represent the cost per ADA divided by the rate of students in that outcome category. A summary of this information is presented in Tables Six through Eight.

| Course Area | Mean | S.D. |
|---|---|---|
| Auto Repair | 3965.94 | 2246.79 |
| Office Occupations | 3278.21 | 1550.11 |
| Data Processing | 3447.87 | 2633.38 |
| Retailing | 3556.94 | 4882.08 |
| Health Occupations | 2994.32 | 1236.49 |
| Quantity Food | 5139.61 | 3108.43 |
| Cosmetology/Barbering | 2543.20 | 2354.67 |
| Construction | 6272.66 | 5861.81 |

**Table 6: Mean Cost per ADA Completer by Course Area**

| Course Area | Mean | S.D. |
|---|---|---|
| Auto Repair | 4367.87 | 2281.37 |
| Office Occupations | 3657.64 | 1729.86 |
| Data Processing | 3819.89 | 2790.58 |
| Retailing | 6074.16 | 19080.15 |
| Health Occupations | 3286.01 | 1291.06 |
| Quantity Food | 5993.61 | 3925.93 |
| Cosmetology/Barbering | 2783.40 | 1662.89 |
| Construction | 7639.16 | 7553.42 |

**Table 7: Mean Cost per ADA Job Placement by Course Area**

| Course Area | Mean | S.D. |
|---|---|---|
| Auto Repair | 4818.40 | 3504.47 |
| Office Occupations | 3910.56 | 2128.78 |
| Data Processing | 4276.74 | 3709.93 |
| Retailing | 6395.68 | 18607.38 |
| Health Occupations | 3415.74 | 1461.01 |
| Quantity Food | 6332.70 | 4657.68 |
| Cosmetology/Barbering | 2806.41 | 1706.45 |
| Construction | 8765.07 | 13676.65 |

**Table 8: Mean Cost per ADA Positive Outcome by Course Area**

No significant differences exist between courses for the ratio computed on the cost per ADA job placement ($F = 1.44$, $p = .19$), and cost per ADA positive outcome ($F = 1.52$, $p = .16$), while differences are apparent in the cost per completer rate ($F = 4.36$, $p = .00$). Courses in construction were found to be significantly more costly for each ADA completer than all other courses except for those in quantity food. Courses in quantity food were more expensive for each ADA completer than courses in cosmetology.

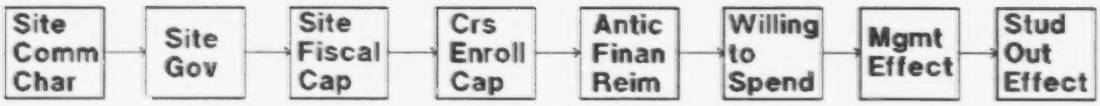
These results illustrate several points. First, it is possible to compute a comparable cost and outcome value on a course-wise basis for each course in each subject area studied. A comparison of costs and outcomes is then possible across all ROC/Ps in the entire state. Individual analyses of the components reveal which courses of instruction are less costly than others, and which produce higher rates of a given outcome (of the three considered).

Second, a cost-effect ratio can be formed relating the normalized costs to standardized units of each outcome. The results of such an exercise can have significantly different meaning depending on which outcome is being considered. Since multiple outcomes are desirable, the choice of which outcome should be maximized is an important one. In actual application the choice may result as a compromise between the best methods for achieving each outcome.

Finally, clear differences are present between the choice of outcomes and the ability of any given course to maximize that outcome. Unfortunately, there is no evidence from this kind of analysis as to the effect of costs, alone or in combination with other programmatic factors, towards explaining the differences observed in either the outcomes or the ratios. Thus, while this information would lead to a decision concerning the most cost-effective method for producing any given outcome it lends little insight as to the effect of costs on the production of that outcome.

## Causal Model Analysis

Further analysis, in the form of structural equation modeling through the use of LISREL-6, was undertaken to examine the sources of variation in course outcomes. A theoretical model of causative events was constructed based on the combination of a prior review of applicable literature and interviews with the Superintendents and Directors of twenty-one of the ROC/P sites. The model assumes a planning strategy on the part of program managers, with rational decisions being made at key points in the decision process. This basic model is depicted in Figure One.




# General Path Model

**Figure 1**

This model consisted of eight nodes:

(1) Site Community Characteristics
(2) Site Governance
(3) Site Fiscal Capacity
(4) Course Enrollment Capacity
(5) Course Anticipated Financial Reimbursements
(6) Course Willingness to Spend
(7) Management Effectiveness
(8) Student Outcome Effectiveness

The first node, site community characteristics, was represented by three specific measures. First was the size of the local population. Represented as POPSIZE in later figures, this variable was the count of the total population in the ROC/P's service area. The density of the local population (POPDENS), on a scale from one (lowest) to three (highest) was solicited from the ROC/P Directors. Finally, the 1980 census median family income for the service area (POPFAMIN) was also included. These measures summarize the broad socio-economic factors influencing overall ROC/P organization and operation.

Site governance was represented by a single indicator, depending on whether the site was operated by a local school district or by a county office of education. Prior field work indicated that a difference might exist between the operational characteristics of ROC/P's that were run directly by districts versus those operated by a county agency. It was hypothesized that ROC/P's with a closer tie to their districts would tend to be more responsive to their individual district's needs and, therefore, more concerned with program outcome attainment than just the conduct of classes.

The fiscal capacity of the site determines its ability to operate both existing course commitments and to expand class sizes and offerings. Three measures of overall fiscal strength were included into the model. The first is shown by the

average state revenue limit reimbursement per ADA (SITRLMIN), representing the typical dollar amount earnable by the site from the State of California for each 525 hours of student attendance. The average income per ADA from non-state revenue limit sources (SITOTHIN), although typically a much smaller amount (usually less than ten percent of overall earnings) was included second. Taken together, these figures represent the income to the site on a per-average-student basis. When this income is sufficient to cover expenditures it is expected that the site's reserve balance would grow (indicating a savings of funds). When expenditures would outpace these sources, however, one could expect the ROC/P to draw funds from its reserve accounts. The final component representing site fiscal capacity was the average per ADA impact on site reserve accounts (SITRESIN), either a contribution to or a draw against.

These first three nodes represent the general environmental characteristics in which the ROC/P operates. The particulars concerning the conduct of any given course are presented in the second area. This includes both the capacity for course enrollments, as well as the financial considerations of anticipated reimbursements and expenditures.

Course enrollment capacity was indicated by four measures. The total number of sections of that course offered (NUMBSECS) detail the number of replications of the course needed to meet the client demand. While replications of larger enrollment courses would tend to produce a containment of costs, similar replications of less popular subjects could end up servicing student needs at a much higher expense. Similarly, centralization and reutilization of the facilities reduces the total overhead required by each course section. Thus, the total number of locations utilized (NUMBLOCS) for each course was also an important theoretical factor to consider. Naturally, any given course can only enroll a fixed number of students in any section. Limitations are imposed both by the nature of the course (such as the number of computer stations available for computer-based instruction), as well as by the planning and execution efforts of the ROC/P (such as the selection of different seating capacity classrooms for seatwork-oriented subjects). The total course student enrollment (TOTENR) reflects this absolute course capacity, as well as some of the ROC/P's success at attracting students into the course. Finally, it would be naive to imagine that all courses experience a similar student drop-out rate. Unfortunately, the computation of student drop-outs is not an easy process, especially in open-entry/open-exit vocational education subjects or differing course lengths. The rate of dropping-out also only represents student exits from the program, and does not speak at all of the rate of attendance associated with students who stay in the program. A measure that captures both of these important concepts is the total ADA generated by the course (ADATOT). Courses that are more adept at retaining students, and encouraging them to attend classes at a higher rate, will increase the total number of hours of student attendance in that course. This will be reflected in the course's ADA totals.

In addition to the issues of course planning, recruiting, and retaining students, each course could be evaluated in terms of its fiscal impact. From a planning perspective, this translates into two distinct nodes of the path model. The first represents the revenue anticipated to be earned from the operation of the course. ROC/P course revenues originate from three distinct sources: state ADA reimbursements (STAREIM), local (non-state) income sources (LOCREIM), and other sources of potential income (OTHREIM). State level reimbursements are based on a combination of the course's attendance accruement ability and an amount reimbursed by the state for each unit of annual daily attendance (decided upon through annual budget deliberations and non-uniform between sites). Such site-level income represent from ninety one-hundred percent of a site's earning from each course. In some cases ROC/P site's are able to augment this state-level reimbursement through various local means (such as grants, contract work, or direct subsidies for course operations). Even less frequently a site would encounter an alternative source of funding, most typically a one-time opportunity grant from a federal or state support agency.

Planning theory suggests that knowledge of the anticipated sources of funding (the combination of course enrollment capacity and attendance potential with the appropriate fiscal reimbursements) would lead program administrators towards a willingness to spend for the conduct of that course. ROC/P course expenditures are broadly summarized into three areas. Personnel expenditures (PEREXP), including salaries and benefits for teachers and support personnel, represents the most expensive portion of most cost offerings. This is true for courses that are conducted by the ROC/P directly. A provision of the California Education Code, however, makes it possible for ROC/Ps to purchase educational services for their students from third party providers. Such contractual education expenditures (CONEXP) represent the second largest source of potential expenditures to an ROC/P. Finally, expenditures for other materials and supplies (OTHEXP), regardless of the method of providing the instructional services, need to be included.

The final nodes describe the outcomes of the course. Four specific outcomes are mentioned by the state, although these represent only two functional areas when considered from the perspective of program planning and execution. Management effectiveness, the first of these two nodes, represents those outcomes over which the staff of the ROC/P has some control. These include both the rate at which students complete the course (PCTCOMT), as well as the rate of student course leaving prior to completion (PCTLEAT). These are not mutually exclusive groups, since a third group, the rate at which students remained enrolled in the course (neither completing nor leaving), exists. Since this third group represents neither direct successes nor failures for the course (especially when the fact of open-entry/open-exit and varied course lengths is considered), they were excluded from direct analysis and did not bias the computation of completer and leaver rates. Outcomes beyond the direct control of the ROC/P include the degree of post-education student success enjoyed by the students. This was ascertained by

two indicators. The first of these was the rate at which students secured employment (PCTSTATE), while the second was the rate at which students found any positive outcome according the ROC/P mission statement (PCTMISS) in the California Education Code. Both rates were determined from the results of site-based follow-up studies, and were calculated as a percentage of the number of students in that outcome group over all students responding to the follow-up procedure. Typically, only students who completed their educational program were included in these follow-up studies. For consistency, the rates in these two nodes were adjusted against the course completion rate in later analyses. Unfortunately, follow-up procedures varied so widely among the ROC/P sites that it was not possible to determine either the validity or reliability of the follow-up data. Instead, it was assumed that error in the process would be uniform across courses and sites.

These measures, and their organization in relation to the nodes of the path model, are summarized in Table 9 below.

Node 1 - Site Community Characteristics

| | |
|---|---|
| POPSIZE | service area population size |
| POPDENS | service area population density (scale of 1 to 3) |
| POPFAMIN | county-wide median family income (1980 census) |

Node 2 - Site Governance

| | |
|---|---|
| SITORG | site governance structure (scale of 1 to 2) |

Node 3 - Site Fiscal Capacity

| | |
|---|---|
| SITRLMIN | site average state (per ADA) reimbursed revenue limit |
| SITOTHIN | site average income (per ADA) from all other sources |
| SITRESIN | site average draw (per ADA) from reserve accounts |

Node 4 - Course Enrollment Capacity

| | |
|---|---|
| NUMBSECS | total course number of sections offered |
| NUMBLOCS | total course number of locations utilized |
| TOTENR | total course student enrollment |
| ADATOT | total course average daily attendances (ADA) |

Node 5 - Course Anticipated Financial Reimbursements

| | |
|---|---|
| STAREIM | total course per ADA reimbursement from state sources |
| LOCREIM | total course per ADA reimbursement from local sources |
| OTHREIM | total course per ADA reimbursement from other sources |

Node 6 - Course Willingness to Spend

| | |
|---|---|
| PEREXP | total course per ADA direct expenditure for personnel |
| CONEXP | total course per ADA direct expenditure for contractual ed |
| OTHEXP | total course per ADA direct expenditure for other expenses |

Node 7 - Management Effectiveness

| | |
|---|---|
| PCTCOMT | ratio of completed students to total enrolled |
| PCTLEAT | ratio of leaver students to total enrolled |

Node 8 - Student Outcome Effectiveness

| | |
|---|---|
| PCTSTATE | ratio of students who found employment to total seeking |
| PCTMISS | ratio of students with positive outcomes to all contacted |

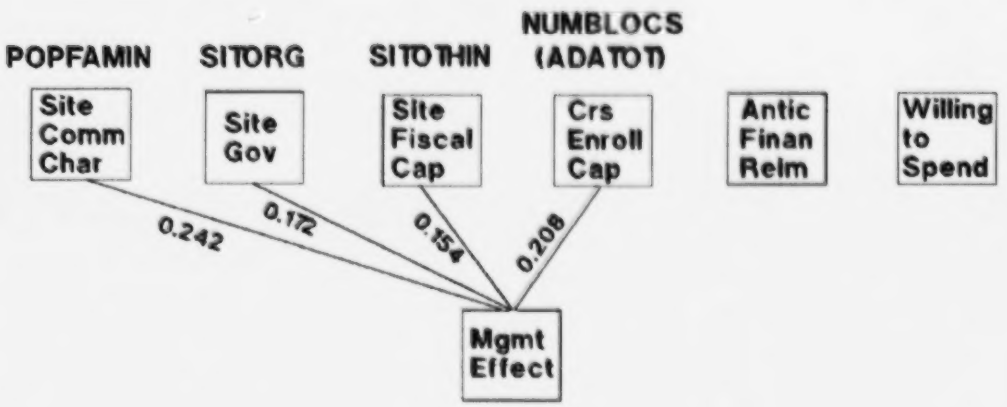
**Table 9: Relationship of Measures to the Path Model Nodes**

A fully-specified model, following the causative path previously outlined, was initially offered. This model specified that each node offered explanatory power to every node following it in the model. Consisting of 190 potential paths, this model both fit the collected data perfectly while offering no parsimony of explanation. Conversely, the most parsimonious model would be a null model, specifying data

only without any causative linkages between the nodes. Such a null model reports a $\chi^2$ of 708.10 (df = 190, p = .00), representing the worst fit between the theory and data. To reach a compromise model a process of iterative reductions was applied to this fully-specified model until only significant and meaningful paths remained. Through this process a final model was determined consisting of a $\chi^2$ of 128.87 (df = 139, p = .72) with an Adjusted Goodness of Fit index of 0.918. This reduced model represents both a significant improvement in explanatory power over the null model and a significant reduction in necessary paths from the fully specified model.

The analysis of the path components contributing to final two nodes representing the program outcomes produced several interesting findings. First and foremost, very little of the variation in any of the four outcome measures can be explained by any combination of the site or course level predictor variables. Only 11.8% of the variation in the rate of course completions, 6.9% in the rate of course leaving, 8.0% in the rate of job placement, and 20.0% percent in the rate of positive student outcome (according to the mission statement) can be accounted for in the model. Thus, while the model is the best combination of theory with data fully four-fifths of the outcome variation remained unexplained.

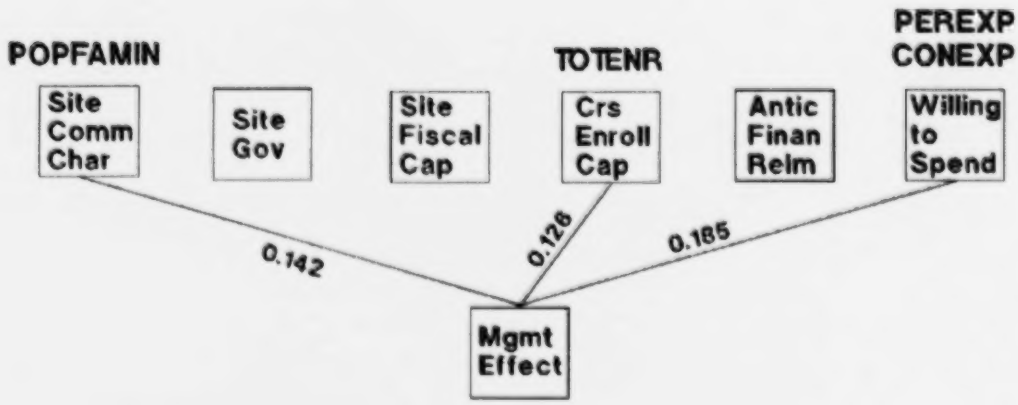
Second, and equally important, is the almost complete lack of fiscal component contribution towards the variation that is accounted for. Neither direct nor indirect effects of fiscal components significantly impact any one of the four outcome measures. While the vocational program might not exist without sufficient fiscal support, this research has found that the variation that does exist is virtually unrelated to the outcomes being assessed. Diagrams depicting the average absolute magnitude of the direct effects (standardized betas) on the two dependent nodes are given in Figures Two through Five, with the standardized solutions for the final model presented in Appendix A.




# Direct Effects on Completer Rate

**Figure 2**

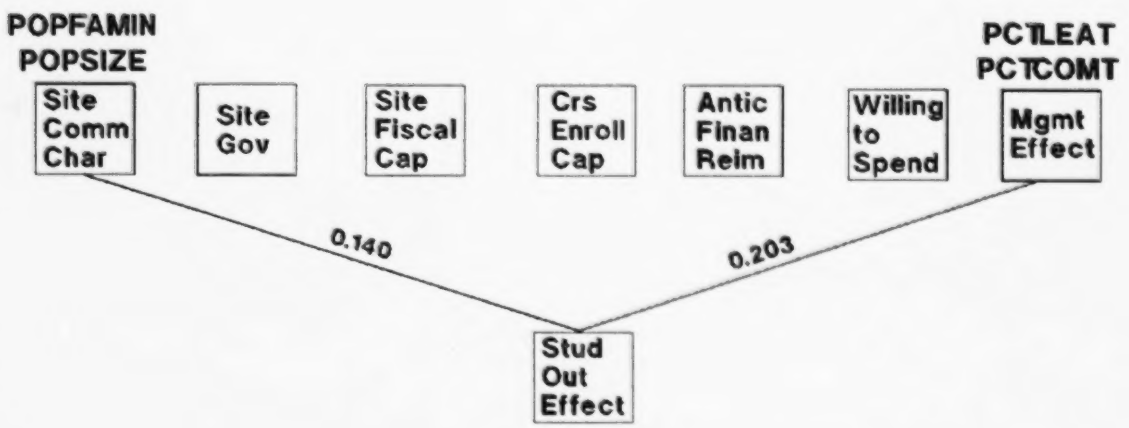
A negative relationship exists between the average ADA earned for a course and the rate of completion, while a positive one exists between the completion rate and the local family median income, other site-level revenues, and the number of locations at which a course is offered. This data, together with an analysis of the indirect paths, suggests that ROC/Ps operating in more affluent areas, conducting smaller courses in more locations, enjoy a higher rate of success in student completions. There is no evidence from this data that finances, either from the site or course level, impact the rate of completion to any significant degree.




# Direct Effects on Leaver Rate

**Figure 3**

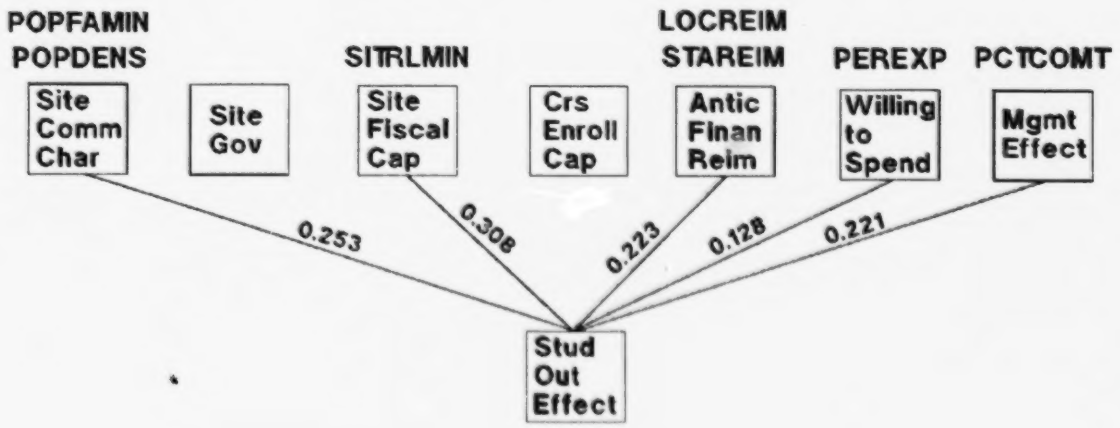
The student leaving rate appears positively related to both the total course enrollment as well to higher per ADA personnel and contractual expenditures. In addition, the leaving rate is negatively related to the local median family income. Analysis of the significant paths leading to the rate of leaving suggest that courses with higher enrollment conducted in lower income areas experience a higher rate of leaving. While that result may not be surprising, the negative association with higher expenditure is. Though the ROC/Ps are, in those cases, spending more money in order to conduct the course those higher expenditures are more closely linked with higher rates of student exit than with student completion.




# Direct Effects on Job Plac Rate

**Figure 4**

Analysis determined that the rates at which students both complete and leave a particular course of study are most highly related to the rate at which students secure employment after exiting the course. A positive relationship also exists between the job attainment rate and the local population median income. One possible explanation is that students from more affluent areas have a somewhat easier time securing post-course employment than do those from poorer locations. Although this is not an entirely unexpected finding, one would expect variations in that rate beyond the local SES factors as a result of program effort. Close examination reveals that, contrary to common thought, the rate of job placement is apparently not related strongly to either course completion or premature course exit. Instead, that rate seems to be almost independent of (and only spuriously correlated with) the management effectiveness measures.




# Direct Effects on Miss Stmt Rate

**Figure 5**

The rate at which students obtained any positive outcome following their course experience (fulfilling the ROC/P mission statement) was found to be positively related to the level of local family income, greater state and local reimbursements for a given course, and higher spending on personnel. This rate was also negatively related to the density of the local population and the higher levels of per ADA reimbursements. These findings suggest that additional funding to the ROC/P, in the form of a higher ADA reimbursement, does not by itself encourage higher rates of positive student outcome. When directed to course-level activities (rather than site-level expenditures) and somewhat higher spending on personnel this increase in financing is related to an increase in positive student outcomes.

## Conclusion

The results of this study demonstrate that cost-effectiveness strategies could be first conceptualized and then applied to California's Regional Occupational Centers and Programs on a statewide basis. The cost-effect ratios computed for the eight programs under study, on each of the three different outcome measures considered, indicated that differences did exist in the cost-effect across certain areas. The investigation of the underlying causative pattern for these variations failed to support the theoretical belief that variations in outcomes result from fiscal differences. In fact, so little of the variation in outcomes could be explained by any

of the factors considered (fiscal, social, and programmatic) that the bulk of the reasons behind program outcome variation as of yet remain unknown.

Many potential reasons exist for such a conclusion. It is possible that the sample studied was too small, or insufficiently representative of the state as a whole to provide for the broad range of variation that might underlie true course variations. The variation between ROC/Ps on the program costs, outcomes, and ratios was extremely large, making it difficult to show clear statistical difference or relationship across the state. It is equally likely that one (or more) important explanatory variables was not included in this research, such a variable carrying the explanatory power that such a model is seeking.

Were this a study of comparative ROC/P practices such concerns would be of more interest. Rather, this study addressed the utility of cost-effects analysis using the very measures that state level policy makers have applied to the question of the effectiveness of vocational education (California State Department of Education, 1971, 1976, 1982, 1983, 1986). Employing these measures in a test of the cost-effect theory has shown that, while the cost-effect ratio can be computed, there is little evidence to support the belief that costs are large component of determining any of the ROC/P program outcomes.

These results open into question the entire applicability of cost-effect theorizing when applied to state-level decision making. If the program outcome measures are mostly unrelated to the program cost measures, as appears to be the case from this research, the relating of cost to outcomes may tend to paint a picture that is disconnected from reality. The more this might be true the greater the possibility that comparative program decisions might be made on the basis of incorrect decision theory and misleading information. As cost-effects methods are receiving increasing attention from key decision makers (Levin, 1988), it is important to insure that the analyses undertaken are supported from the underlying relations of the data.

Sensible managers want methods that allow them to choose programs that produce the highest rate of outcome for the least rate of cost. When methods of production and the constraints on operation, markets, and funding are similar the application of cost-effect methodology may provide an adequate summary of efficiency. When these factors vary, resulting in little apparent connection between costs and outcomes, such ratios may overestimate the contribution that fiscal power makes to outcome production. In those cases more sophisticated techniques ought be employed to what actually drives the cost-outcome variations.

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## Appendix A: LISREL Standardized Solutions Beta Matrix

| | Popsize | Popdens | Popfamin | Sitorg | Sitrlmin |
|---|---|---|---|---|---|
| Popsize | | | | | |
| Popdens | | | | | |
| Popfamin | | | | | |
| Sitorg | 0.308 | -0.172 | | | |
| Sitrlmin | | -0.165 | 0.363 | 0.168 | |
| Sitothin | | | -0.167 | -0.360 | |
| Sitresin | | | | | |
| Numbsecs | 0.512 | | 0.081 | | |
| Numblocs | 0.548 | | | | |
| Totenr | 0.544 | | | | |
| Adatot | 0.537 | | | | |
| Stareim | | -0.090 | | 0.252 | 0.342 |
| Locreim | | | | -0.312 | 0.122 |
| Othreim | | | | | |
| Perexp | | | | 0.225 | |
| Conexp | | | | -0.190 | |
| Othexp | | | | | |
| Pctcomt | | | 0.242 | 0.172 | |
| Pctleat | | | -0.142 | | |
| Pctstate | -0.117 | | 0.163 | | |
| Pctmiss | | -0.249 | 0.256 | | -0.308 |

| | Sitothin | Sitresin | Numbsecs | Numblocs | Totenr |
|---|---|---|---|---|---|
| Sitothin | | | | | |
| Sitresin | | | | | |
| Numbsecs | | | | | |
| Numblocs | | | | | |
| Totenr | | | | | |
| Adatot | | | | | |
| Stareim | 0.144 | | 0.175 | -0.249 | |
| Locreim | | | -0.221 | 0.289 | |
| Othreim | | | | | |
| Perexp | | | | | 0.230 |
| Conexp | | | | | |
| Othexp | | | | | |
| Pctcomt | 0.154 | | | 0.149 | |
| Pctleat | | | | | 0.126 |
| Pctstate | | | | | |
| Pctmiss | | | | | |

## Appendix A: LISREL Standardized Solutions Beta Matrix

| | Adatot | Stareim | Locreim | Othreim | Perexp |
|---|---|---|---|---|---|
| Adatot | | | | | |
| Stareim | | | | | |
| Locreim | | | | | |
| Othreim | | | | | |
| Perexp | -0.374 | 0.369 | 0.384 | 0.137 | |
| Conexp | | | | | |
| Othexp | | 0.444 | 0.361 | | |
| Pctcomt | -0.267 | | | | |
| Pctleat | | | | | 0.197 |
| Pctstate | | | | | |
| Pctmiss | | 0.207 | 0.239 | | 0.128 |

| | Conexp | Othexp | Pctcomt | Pctleat | Pctstate |
|---|---|---|---|---|---|
| Conexp | | | | | |
| Othexp | | | | | |
| Pctcomt | | | | | |
| Pctleat | 0.173 | | | | |
| Pctstate | | | 0.182 | 0.223 | |
| Pctmiss | | | 0.221 | | |

| | Pctmiss |
|---|---|
| Pctmiss | |